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from that found in Botrychium; while in Helminthostachys the fertile spike is interpreted as representing a single pinna. This would dispose of the sporangiophore nature of the spike, and revert to ROEPER'S view (in 1826) that it represents two fused basal pinnae.

The general conclusion is that the Ophioglossaceae are related to the ferns, and "have sprung from near the level of the Osmundaceae."—J. M. C.

The strobilus of Selaginella.—Miss GERTRUDE MITCHELL[32] has recorded some general studies of the strobilus of Selaginella, which fill up certain gaps in our knowledge, and "confirm or controvert statements" of other investigators.

In some species the axis was observed to renew its ordinary vegetative character beyond the strobilus: in one case abortive sporangia were produced in the axils of the foliage leaves just beyond the tip of the strobilus; in another species a second strobilus was produced upon such an axis, the two strobili being separated by a sterile region; and in still another case a branched strobilus was noted. The distribution of sporangia is variable, and species are enumerated under the following heads; one large basal megasporangium, several basal megasporangia succeeded by microsporangia, strobili wholly megasporangiate or microsporangiate, and an indiscriminate arrangement. The species are also enumerated that mature one, two, or three megaspores, instead of the more usual four, and also two rare cases in which there are twelve (*S. Vogelii*) and eight (*S. involvens*) megaspores. Considerable attention is given to the sporangium wall and its mechanism for dehiscence, involving what are spoken of as "its wonderful adaptations for cross-fertilization." The paper closes with a brief consideration of the vascular anatomy of the strobilus and the ligule.—J. M. C.

The stele of Osmunda.—The vascular anatomy of this genus has given rise to much discussion and to divergent opinions as to its phylogenetic significance. FAULL[33] has now investigated abundant material of the sporelings of *O. cinnamomea* in all stages, and has reached the following results and conclusions: The cortical cells at the base of the sporeling are inhabited by a fungus. While there is considerable variation in the development of different individuals, in no case is the transition from protostele to siphonostele effected by a simple expansion, as has been claimed for Osmundaceae. There are bays or gaps in the xylem near the nodes, which may result in inclosing a "stelar" pith. Rarely and only in adult stems does the internal endodermis and "extrastelar" pith connect with the external endodermis and cortex through leaf gaps. Internal phloem has been found in unbranched adult plants, and this fact, together with the absence of branching in the sporeling, is thought to indicate that internal phloem and internal endodermis in this family have not "intruded" through branch gaps. The general conclusion is that the stele of the existing Osmundaceae is a "reduced amphiphloic siphonostele," and that it is consistent with JEFFREY'S theory of the origin of the siphonostele and the homology of the pith.—J. M. C.

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[32] MITCHELL, GERTRUDE, Contributions towards a knowledge of the anatomy of the genus *Selaginella* Spr. Part V. The strobilus. Annals of Botany **24**:19–34. *pls. 3, 4.* 1910.

[33] FAULL, J. H., The stele of *Osmunda cinnamomea*. Trans. Canadian Inst. **8**:515–534. *pls. 4–6.* 1909.

Morphology of Laminaria.—A knowledge of the reproduction of Laminaria has long been a desideratum, and this has now been supplied to some extent by DREW,[34] who has succeeded in making cultures according to methods he describes. He has concluded that the "sporangia" described as imbedded in the reproductive areas are in reality gametangia. These gametangia produce gametes (heretofore thought to be zoospores) which conjugate and produce zygospores. The zygospores give rise to a chain or mass of cells which may represent the $2x$ generation; and this in turn gives rise to the Laminaria plant, which represents the x generation. The x and $2x$ conditions are inferences, as no cytological work was done; and the direct outgrowth of the young Laminaria plants from the "chain or mass of cells" would hardly suggest an intervening reduction division. However, the discovery that the reproductive areas consist of gametangia and paraphyses is of sufficient interest. The gametes when liberated seem to have no cilia, but soon develop them. The cells of the structure (chain or mass) produced by the zygospore "rupture, and their contents grow out to form the gametophyte." Details are given of the development of the various regions and tissues of the young plant.—J. M. C.

The ecology of Zostera.—OSTENFELD has given an interesting ecological account of *Zostera marina*, as seen in Denmark.[35] The structure and growth of the plant is first treated in detail, following which is an account of the necessary life conditions of the plant and the variations in diverse habitats. While Zostera requires salinity, it thrives where the percentage of salt is high (3.3 per cent), and also where it is very low (0.6 per cent). It occurs only in relatively quiet waters, and grows at greater depths in clear than in muddy waters, sometimes living at as great a depth as 11^m where the water is very transparent. The most important factor in determining its luxuriance appears to be the character of the bottom, plants on firm sand having short narrow leaves, whereas plants in mud have long broad leaves (sometimes more than 2^m in length). A detailed account of the distribution of Zostera in Danish waters is followed by a discussion of the Zostera vegetation as a habitat; many plants and animals live where a Zostera vegetation has become established, the plants themselves often being covered with many forms. Other flowering plants that grow with Zostera are briefly described.—H. C. COWLES.

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[34] DREW, G. HAROLD, The reproduction and early development of *Laminaria digitata* and *Laminaria saccharina*. Annals of Botany **24**:177–190. *pls. 14, 15.* 1910.

[35] OSTENFELD, C. H., On the ecology and distribution of the grass-wrack (*Zostera marina*) in Danish waters. From Report Danish Biological Station. pp. 62. *figs. 9.* Copenhagen. 1908.